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Coordinated spectral analysis of H2020/PTAL mineral samples

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The PTAL project aims at building and exploiting a database, the Planetary Terrestrial Analogues Library, in order to characterize the mineralogical evolution of terrestrial bodies, starting with Mars. A total of 94 natural Earth rocks have been collected on selected locations around the world to get martian analogues and to prepare future in situ investigations using NIR, LIBS and Raman techniques.

Each sample is first characterized with XRD and thin section observation (Oslo University) to obtain the main rock classification and the lithological description, including natural alteration products.
Then, NIR spectroscopy (Paris-Sud University) is used according to two techniques. We have a FTNIR spectrometer that mimics spectral characterization of IRS/Mars2020 (a point spectrometer) and a spare model of MicrOmega/ExoMars (a hyper spectral microscope) for better comparison with both missions instrumentation. The point spectrometer is used on powder, while MicrOmega is very useful to highlight mineralogical heterogeneity of bulk samples.
Raman spectroscopy (Valladolid University) is then performed and offers a unique complementarity to the NIR as some compounds are better detected with Raman. It also gives information on the crystalline/amorphous state. The selected strategy involves the complementary use of two different analytical systems. The overall molecular characterization of powdered samples is first performed through a Raman spectrometer assembled in the laboratory (laser excitation emitting at 633 nm). Further analysis is then carried out with the so-called RLS ExoMars simulator (emitting at 532 nm).
The final step in the multiple spectroscopic analysis loop is the LIBS (Toulouse University) using a spare model of ChemCam/Curiosity that provides the elemental composition.

These techniques are similar to the instruments on board current and forthcoming martian missions. We perform coordinated analysis between all techniques including compositional comparison; examples will be presented during the conference. This is a new scientific field not yet explored at such a large and systematic scale. Such combined analysis — with techniques that have never been brought together to Mars surface yet — should give the opportunity to prepare and improve ExoMars/ESA and Mars2020/NASA observations.

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